Expressive Compositing for Augmented Reality

Xavier Granier, Jiazhou Chen

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Xavier **Granier** & Jiazhou **Chen**

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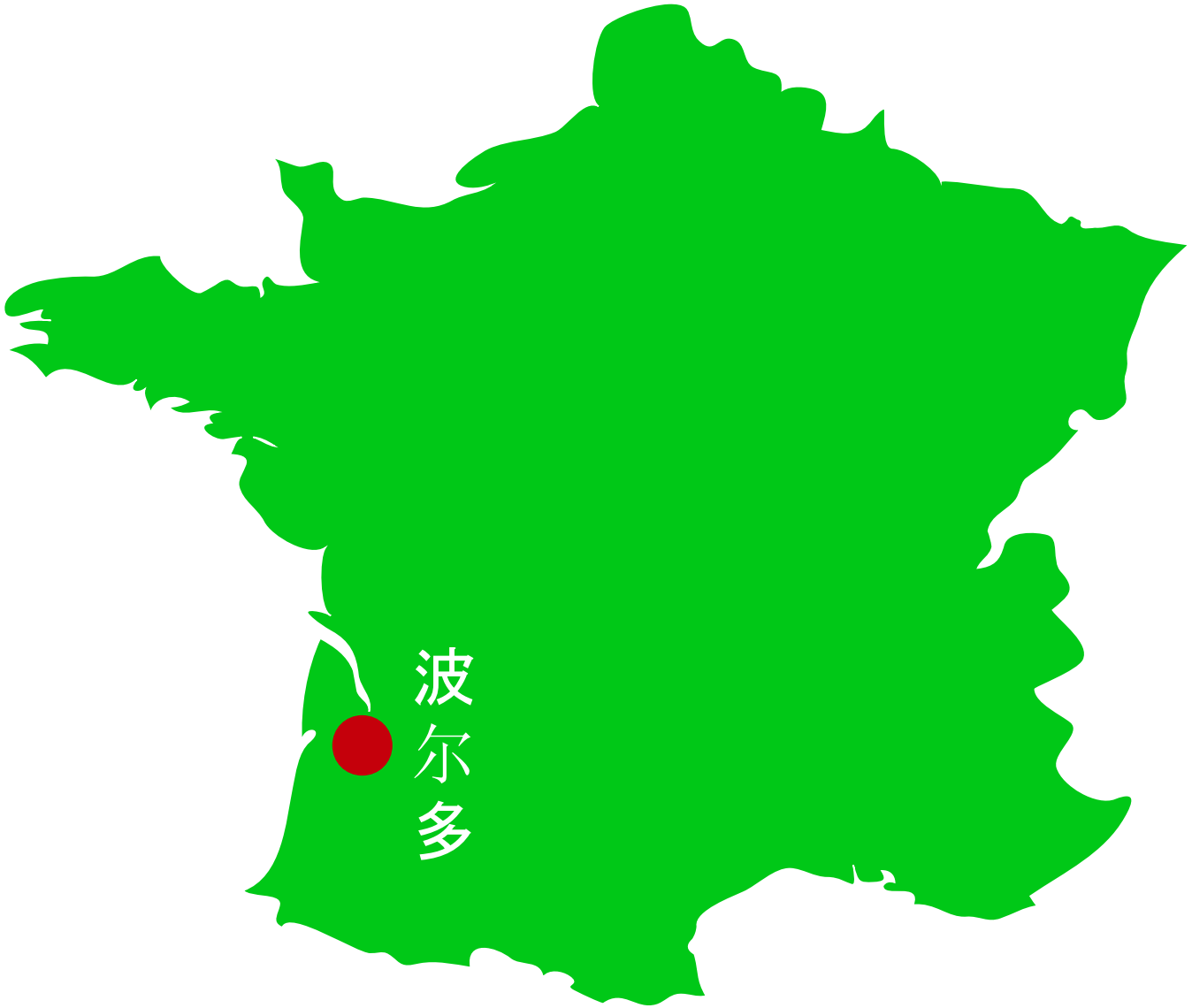
玛瑙科研组在哪里？



玛瑙科研组是什么？

- Joint team

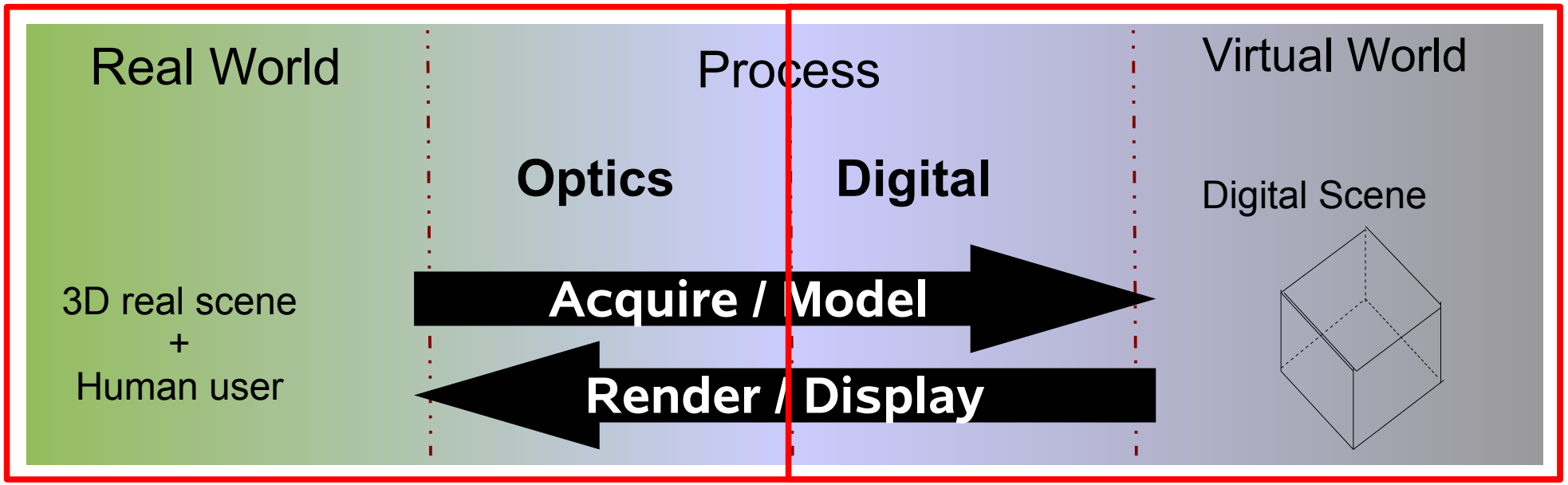
LP2N

- Goals
  - **Study, model, acquire** interactions between light, shape and matter
  - **Take into account observers** (humans or sensors)
- 4 axes
  - Analysis and Simulation
  - Acquisition and Display
  - Rendering, Visualization and Illustration
  - Creation and Edition

Our approach: beyond Computer Graphics

A global view but specialized of processes

- **Real World**:
  - Physics and Optics laws
  - Human abilities
- **Virtual World**: models & algorithms



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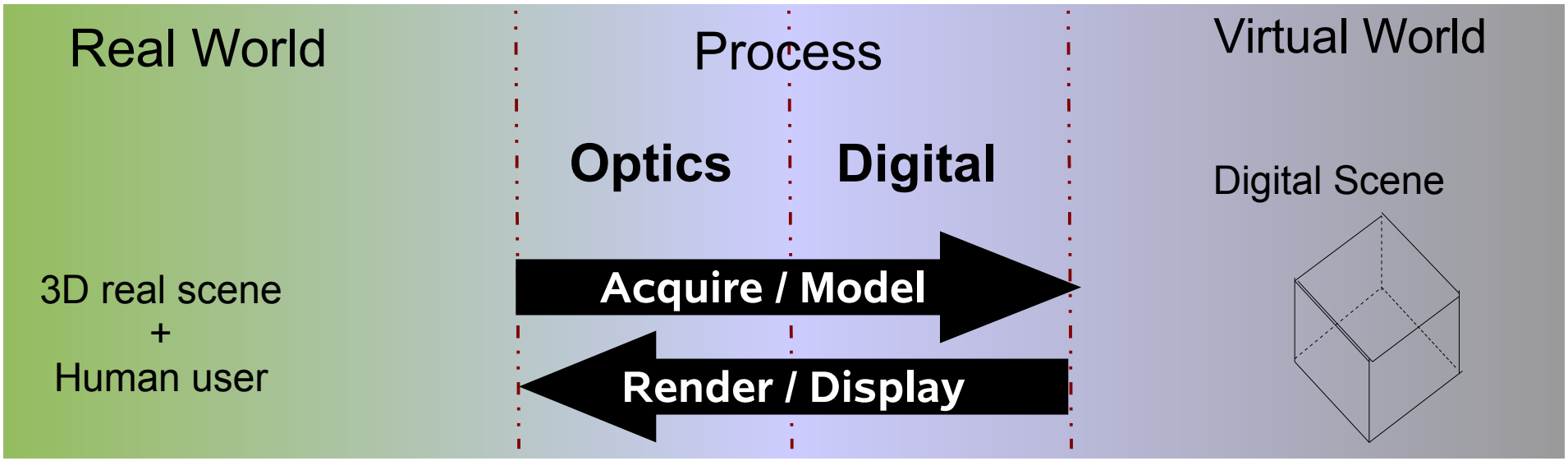


Members

Xavier Granier
Inria Research Scientist

Jannick Rolland
Professor @ Rochester & Optics Institute

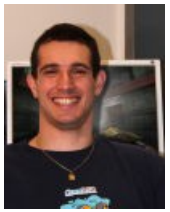
Christophe Schlick
Professor @ Univ. Bordeaux

+2 Postdocs
+5 PhD Students
+3 Master Students

Pascal Barla
Inria Research Scientist

Gael Guennebaud
Inria Research Scientist

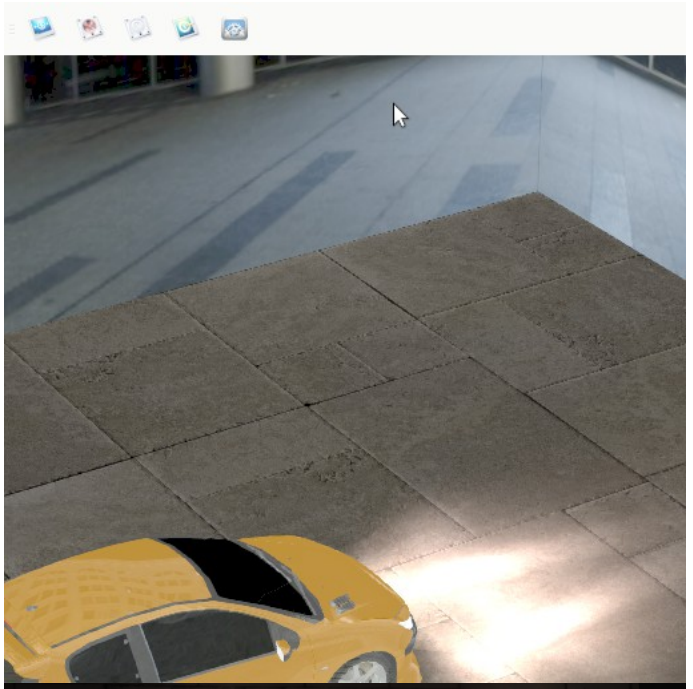
Ivo Irhke
Inria Research Scientist



Romain Pacanowski
CNRS Research Engineer

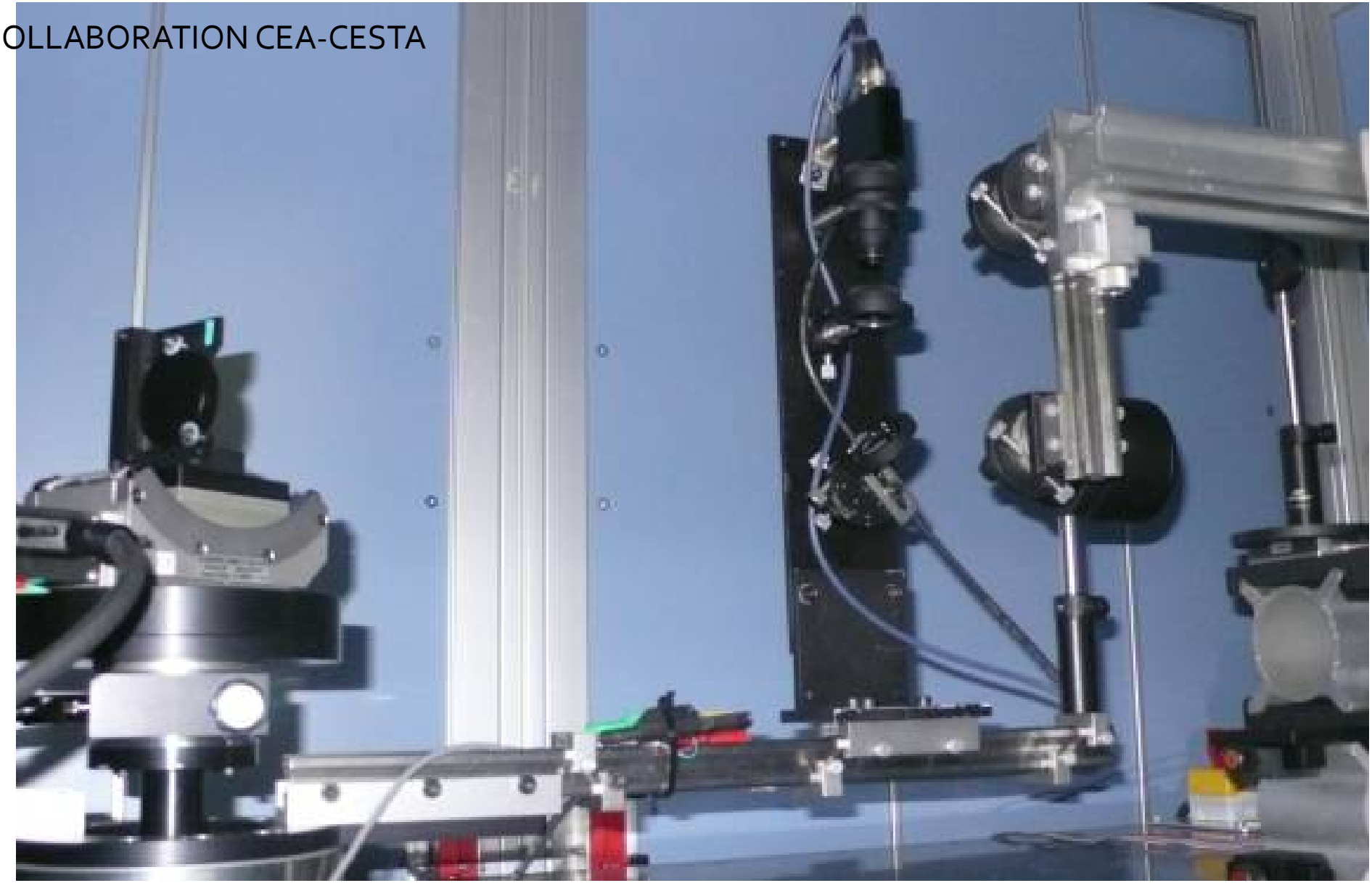
Patrick Reuter
Assistant Professor @ Univ. Bordeaux

New Setup and Rendering

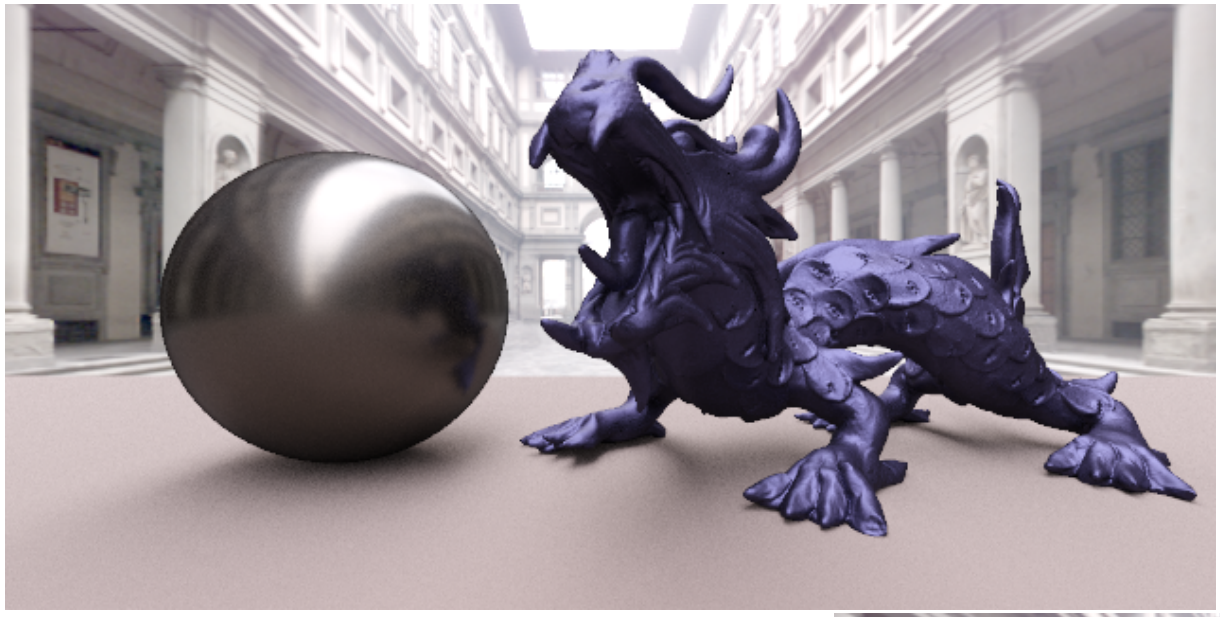


BRDF Acquisition

COLLABORATION CEA-CESTA

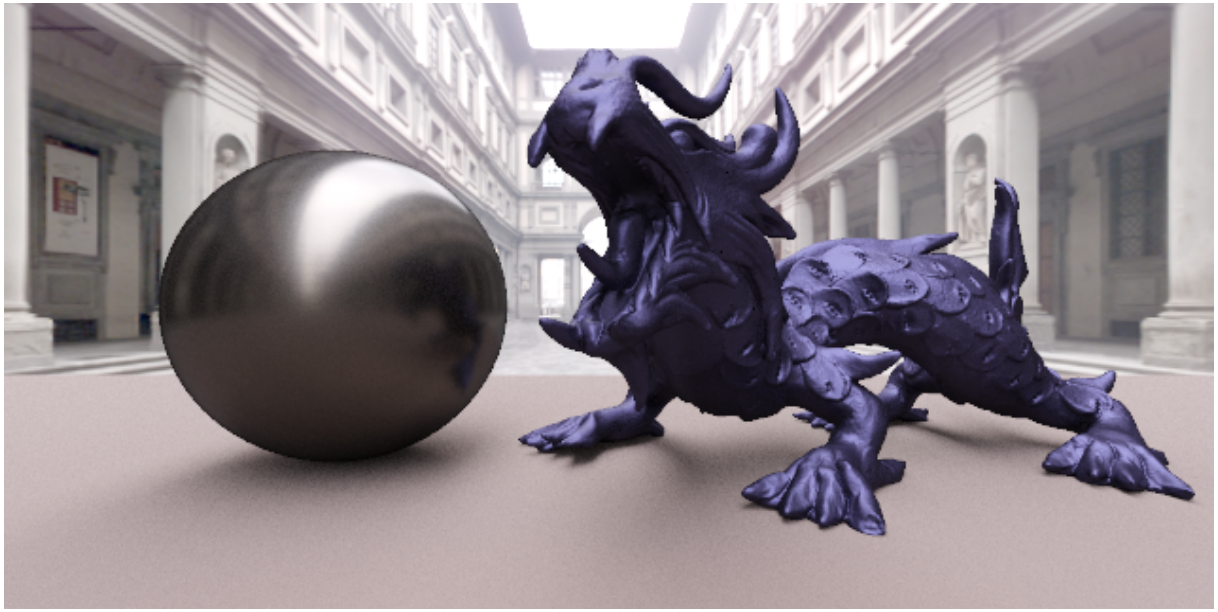


Accurate Approximation of BRDF



Original Data
99 MB

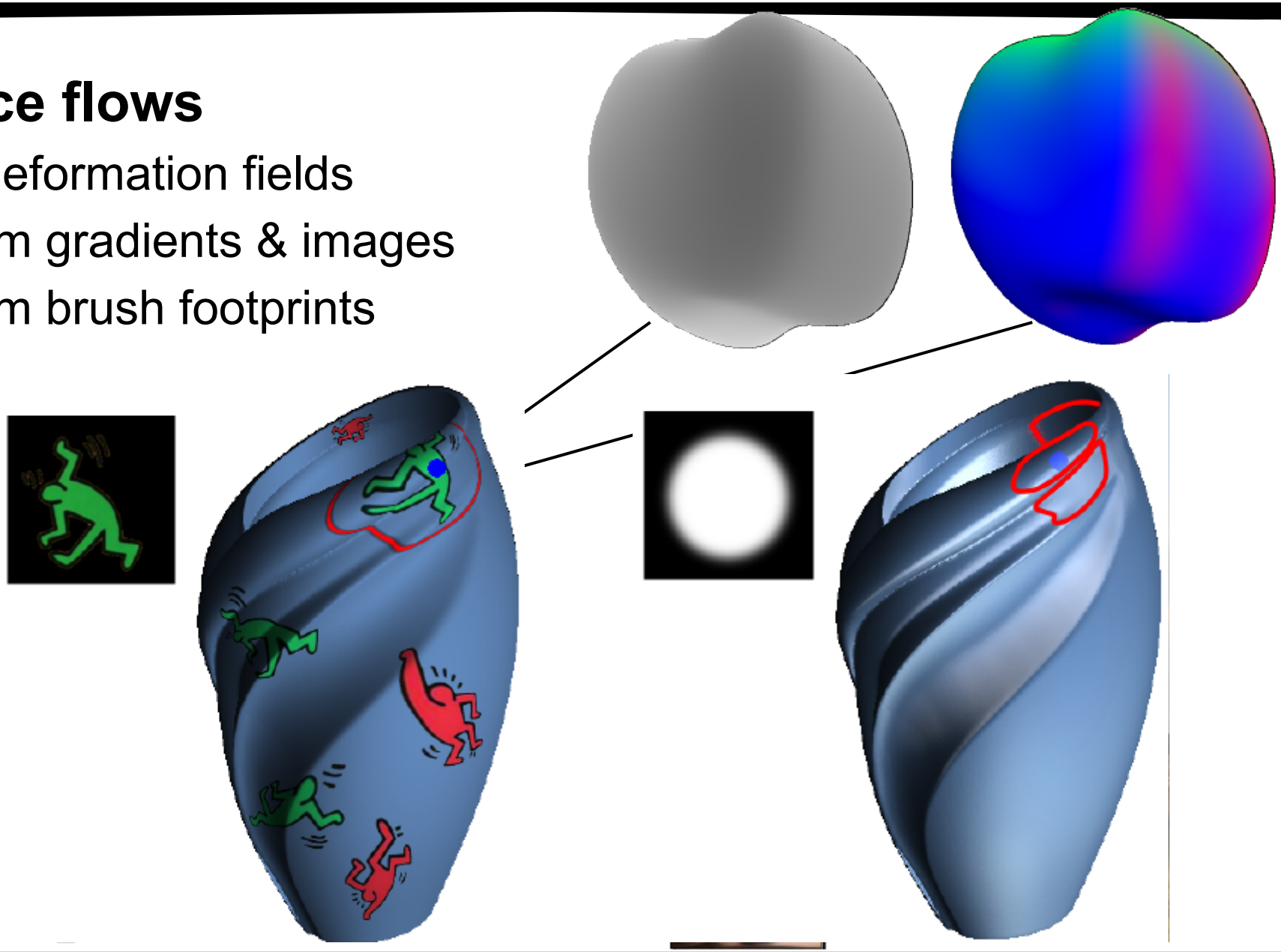
Approximation
1,7 kB



[Pacanowski et al. – TVCG 2012]

Shading by Image Deformation

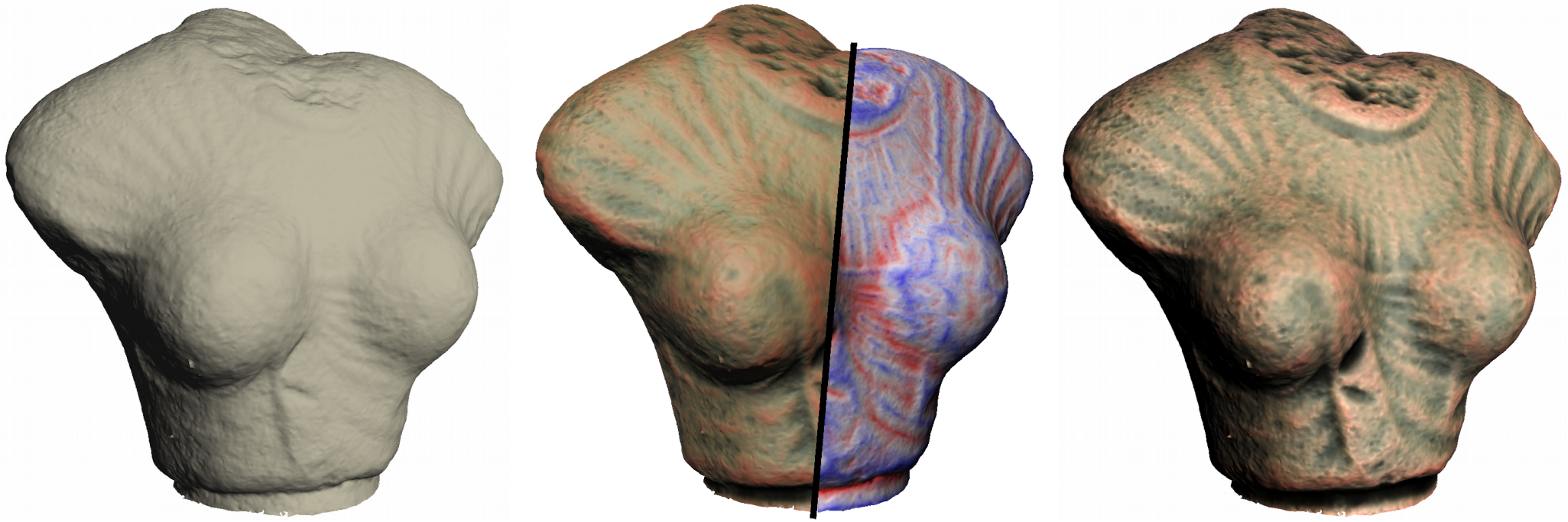
- **Surface flows**
  - Two deformation fields
  - Deform gradients & images
  - Deform brush footprints



[Vergne et al. – SIGGRAPH 2012]

Illustrative Shading

- Based on new relief analysis
  - **Non-local**: features in neighborhood
  - **Multi-direction**: better anisotropy / filtering
  - **Multi-scale**: feature size



[Ammann et al. – EGSR 2012]

AR: Tracking of Outdoor Lighting

[Liu & Granier – IEEE VR 2012]

Expressive Compositing for Augmented Reality

State Key Lab of CAD&CG, Zhejiang University

Motivation

- **Visualization of underground pipelines in video streams**
  - With visually **correct occluding order**
  - **Without 3D geometry** of the real environment

Artistic painting on a street

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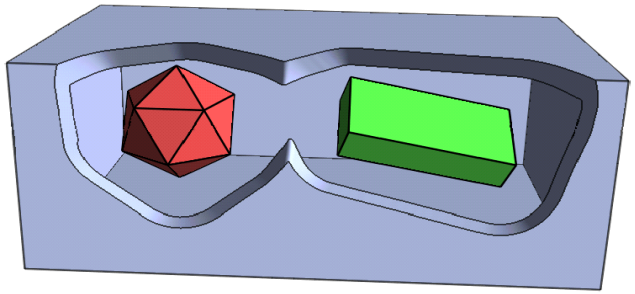
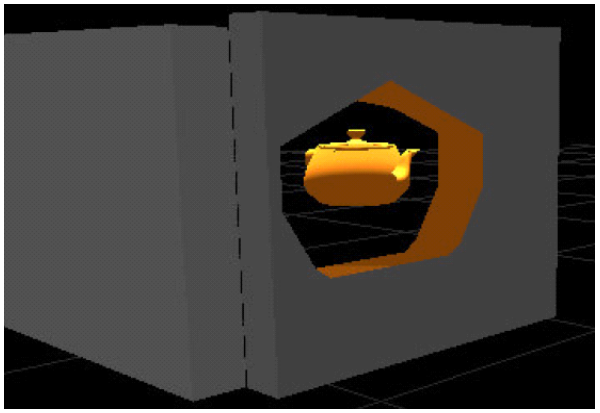
Related work

- **Cutaways**

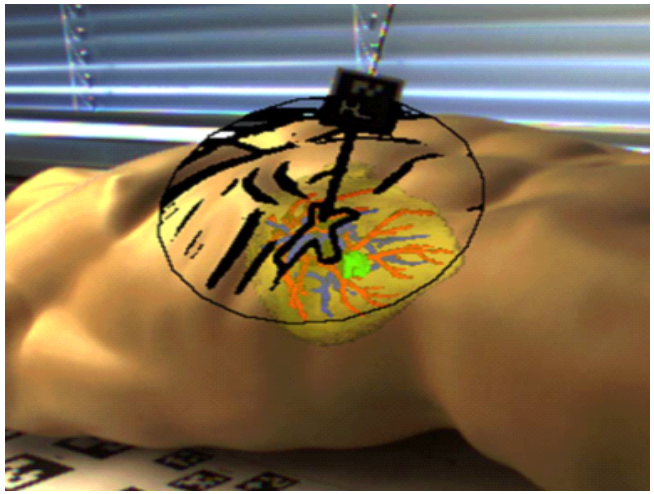


[Burns & Finkelstein 2008]

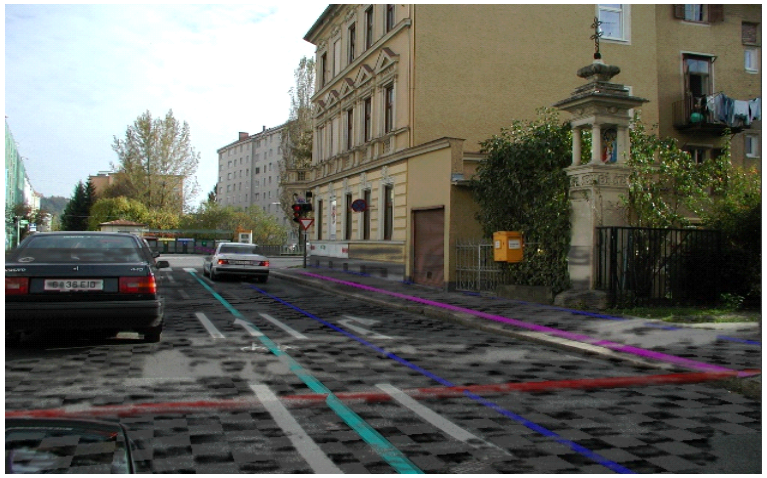


[Coffin et al. 2006]

- Transparency (**Focus+Context** rendering)



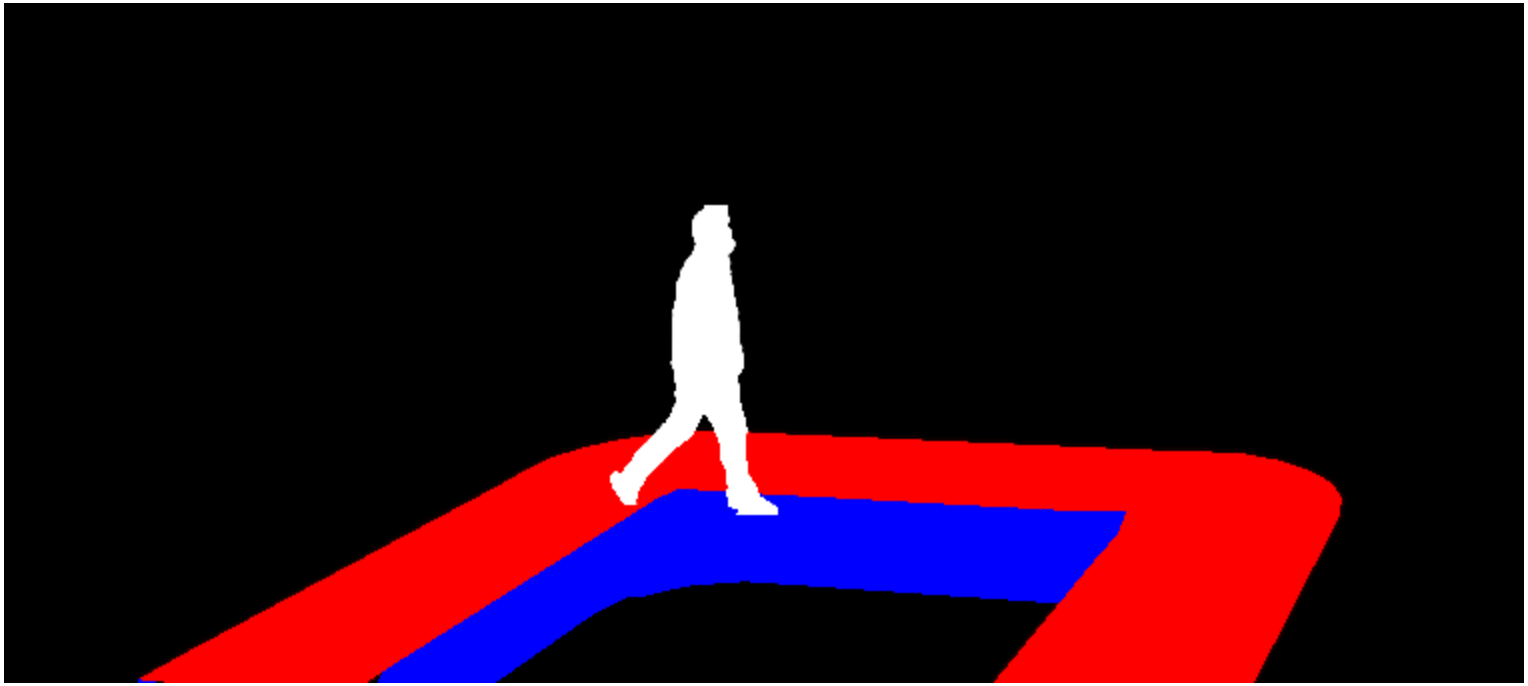
[Kalkofen et al. 2007]



[Zollmann et al. 2010]

Segmentation into Depth-ordered Regions

- Video segmentation [Zhong et al. 2009]
- Separation of front and back faced surfaces



□ Moving Context ■ Static Context

■ Main Focus ■ Second Focus

Region-based Compositing

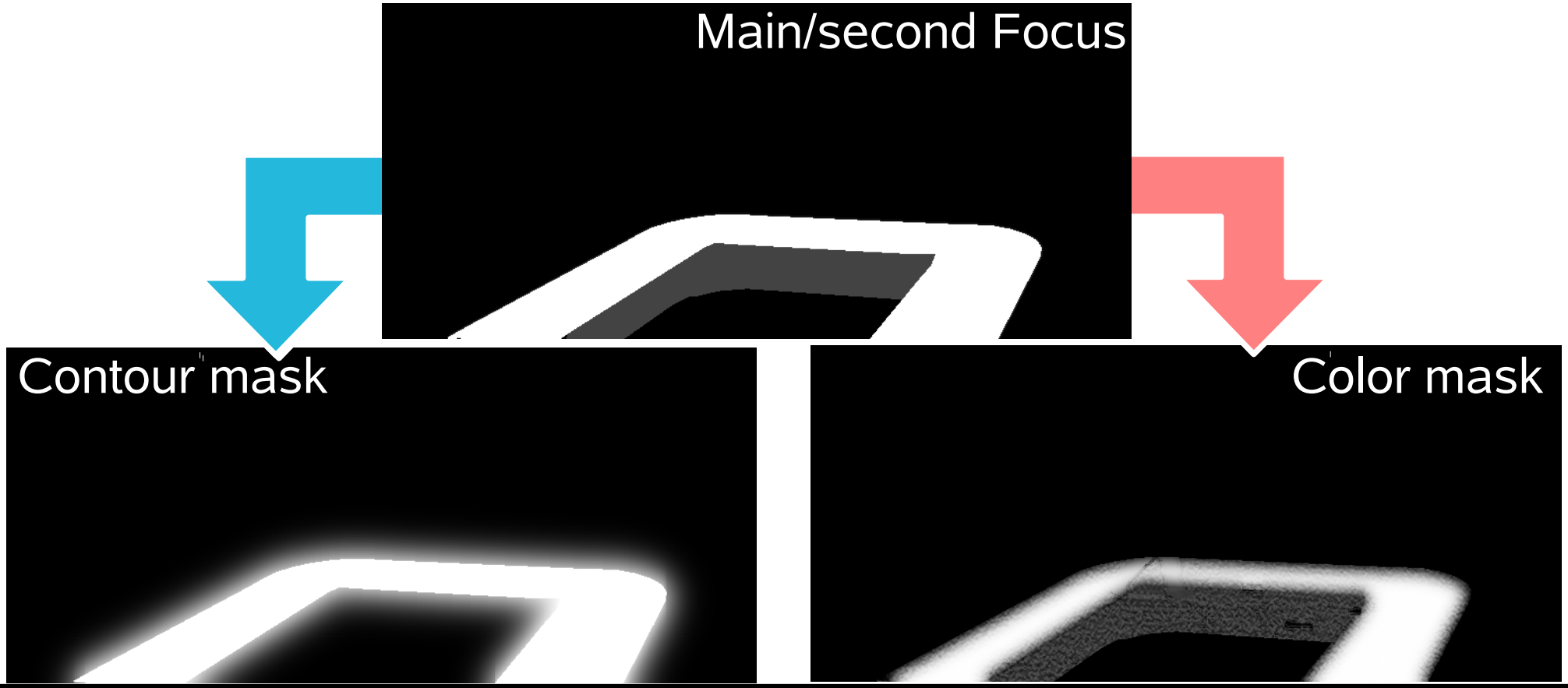
- Moving contexts on the top
- Transparency for second focus

Depth Cues Using Contours

- **Contours** from pipelines and video streams
- But, boundary-breaking problem

Compositing Masks

- To preserve the **context continuity**
  - Smooth outside using Gaussian filter
  - Smooth inside using cross bilateral filter [Eisemann et al. 2004]



Final compositing

- **Contrast enhancement**
  - around contours

Unsharp masking [Badamchizadeh et al. 2004]

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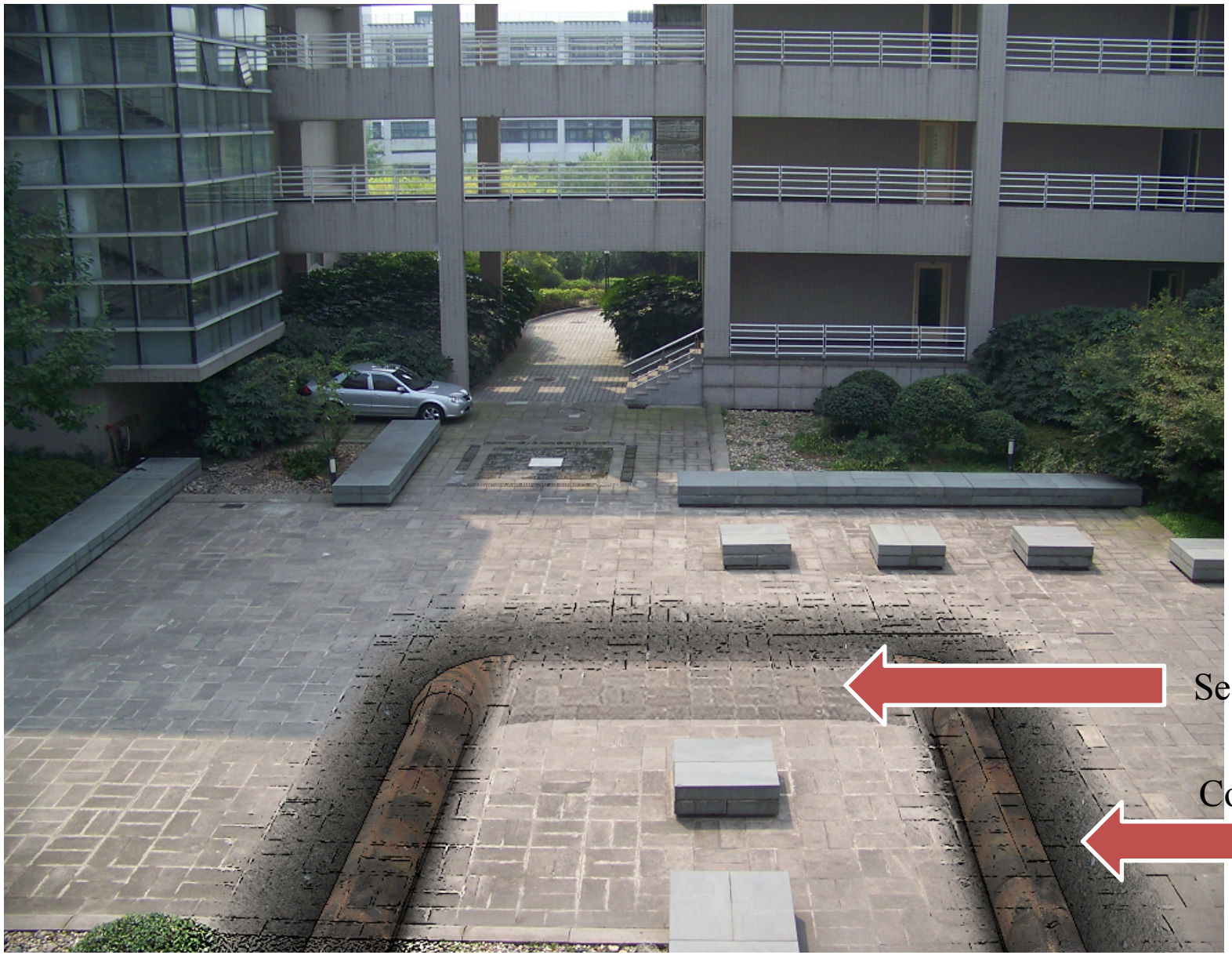
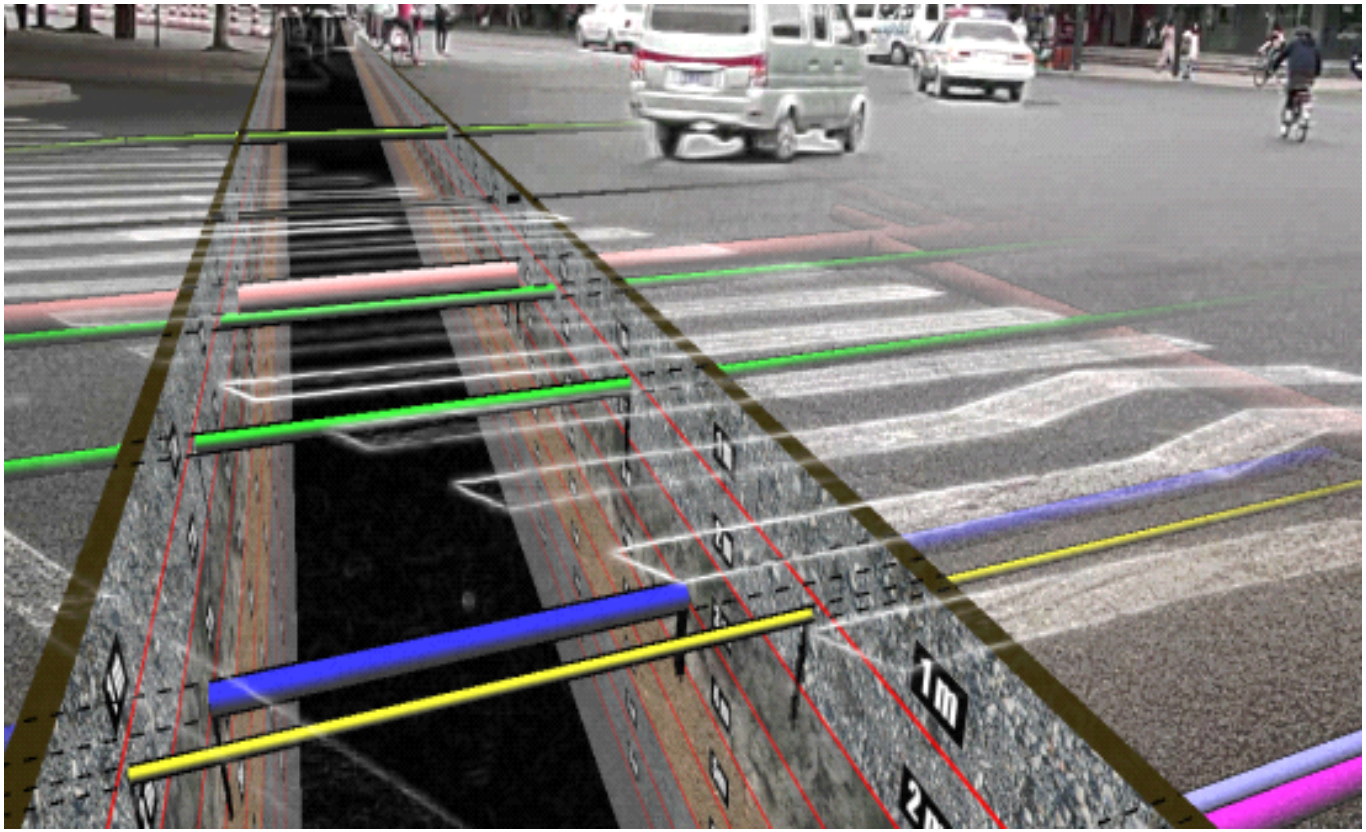
Unsharp masking [Badamchizadeh et al. 2004]

Result using a Tunnel Cutaway

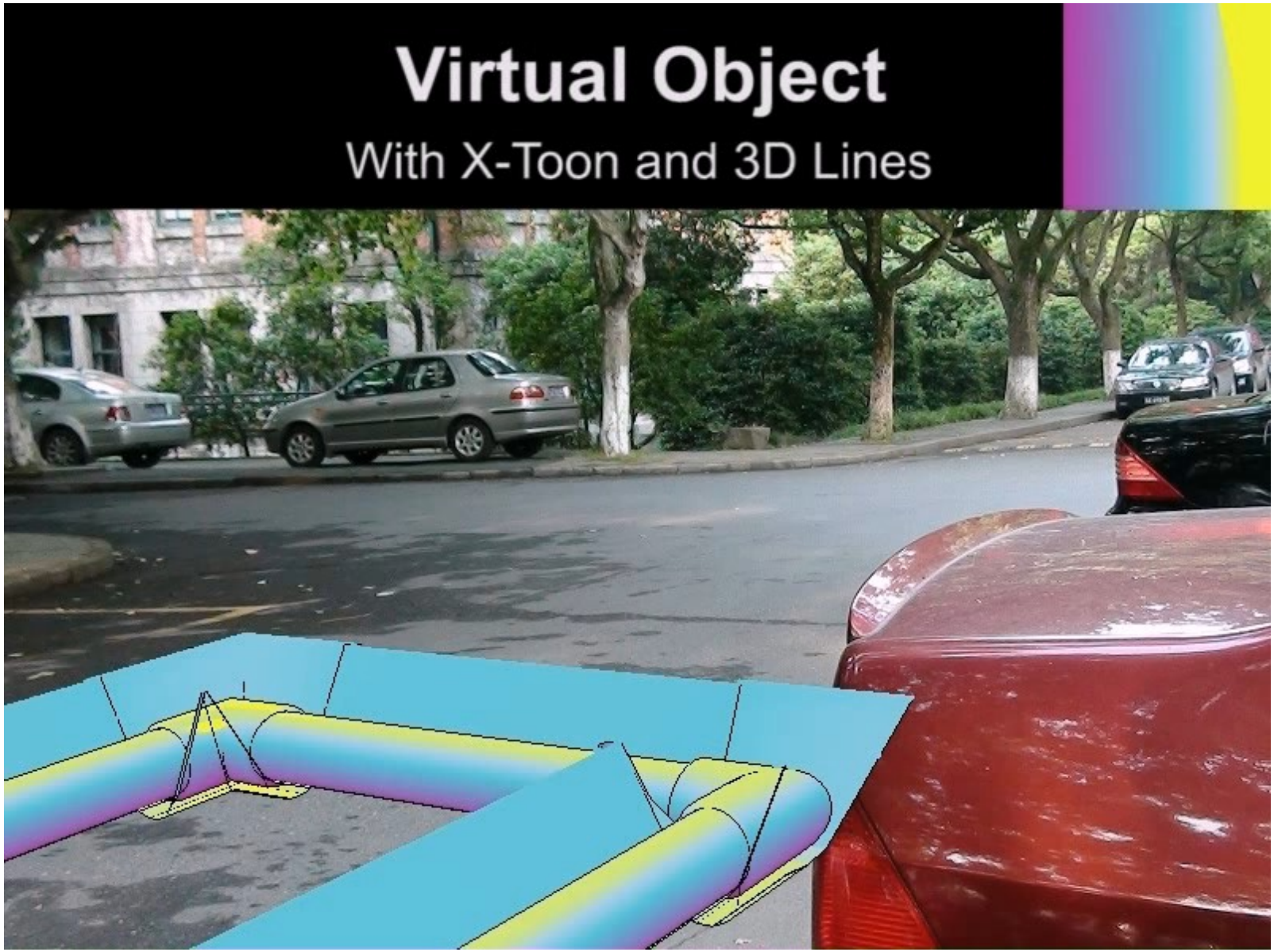


Result using other Cutaway Geometry

- Shadow casting
- Depth marks



Video 1



Video 2

Conclusion

Summary & Limitations

- **Expressive Rendering**
  - Better visualization of occluding order
  - Do not require 3D geometry of the real environment

- **Limitations**
  - Moving camera
    - Camera registration
  - Quality of contours
    - Need improved contour detection
  - Only planar geometry

谢谢！
Merci !

State Key Lab of CAD&CG, Zhejiang University

http://manao.inria.fr

http://www.cad.zju.edu.cn/